

PRELIMINARY STUDY ON THE EFFECT OF LED LIGHT AND CYTOKININE ON THE GROWTH OF PEAR PLANTS *IN VITRO*



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Material and Methods

Plant material and experimental conditions

The experiment was carried out on pear rootstock (*Pyrus communis* L. 'Old Home' x 'Farmingdale' 333). Briefly, shoots were grown in microboxes with green filter (SacO₂, Belgium) on a modified MS (Murashige and Skoog, 1962) solid medium with ½ concentration of NH₄NO₃ and CaCl₂ and 1000 mg L⁻¹ Ca(NO₃)₂, supplemented with 2.5 µM 6-benzylaminopurine (BAP), 0.05 µM IBA, 30 g L⁻¹ sucrose, 6.5 g L⁻¹ Phyto agar (Duchefa, The Netherlands). The cultures were incubated in the growth room at an air temperature of 22±2°C with 16/8 h hours photoperiod supplied by cool-white fluorescent lamps (OSRAM 40W; 50 µmol m⁻²s⁻¹ PPFD).

For the purpose of the present experiment the plantlets were cultivated *in vitro* on above mentioned basal nutrient medium, supplemented with 2.5 µM 6-benzylaminopurine (BAP) or 2.5 µM meta-Topolin (mT) at 22±2°C using an illumination system based on Philips GreenPower LED research module (16-h photoperiod with 80-95 µmol m⁻² s⁻¹ PPFD). Three groups of LEDs emitting in white (W), blue (B), mixed (BR) (W:B:red:far-red = 1:1:1:1) lights) were applied. Data on fresh (FW) and dry (DW) mass, number and length of shoots, the length and width of the first fully developed leaf, content of photosynthetic pigments was evaluated in six passages of three weeks of culture on the corresponding light regime.

For each light treatment three replications, each containing ten shoots was tested and the experiment was repeated three times. Statistical analysis of physiological parameters was performed using a one-way ANOVA using the Tukey test to validate the different significance at $P \leq 0.05$.



Fig. 2. Gas-exchange filters of the polypropylene containers allows air flow, but blocks contamination.

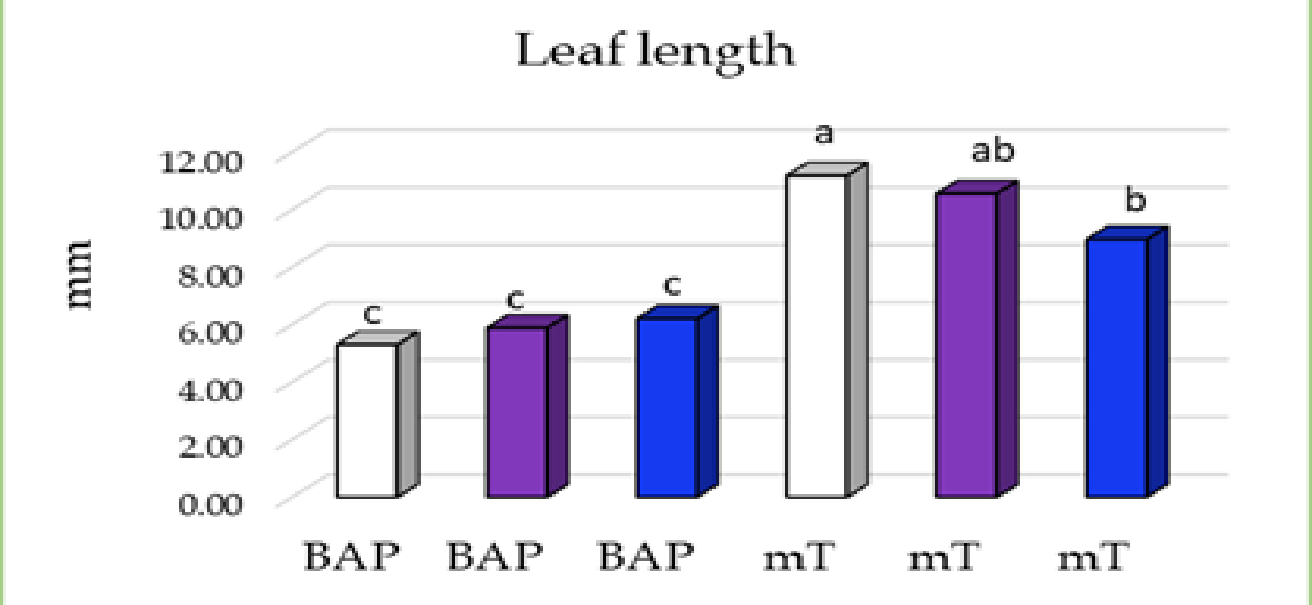
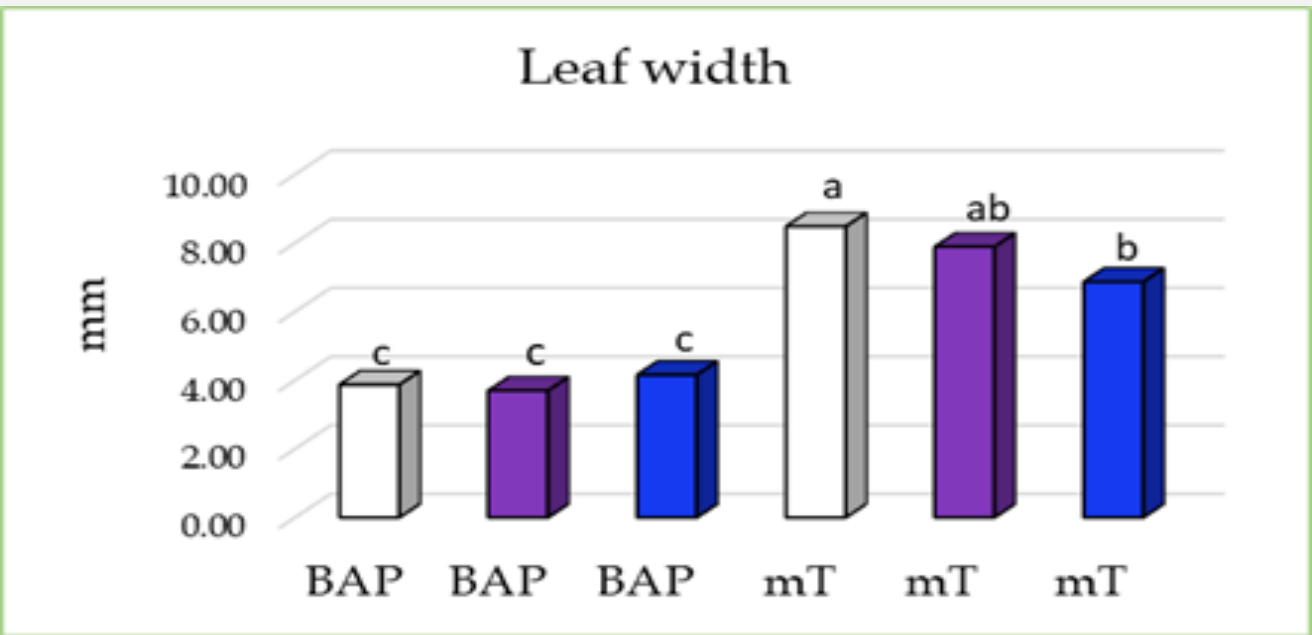


Fig. 3. The size of the first fully developed leaf of pear plantlets, grown with BAP or mT in the nutrient medium at different light treatments. W white LEDs, B – blue LEDs, BR – mixed LEDs.

Results

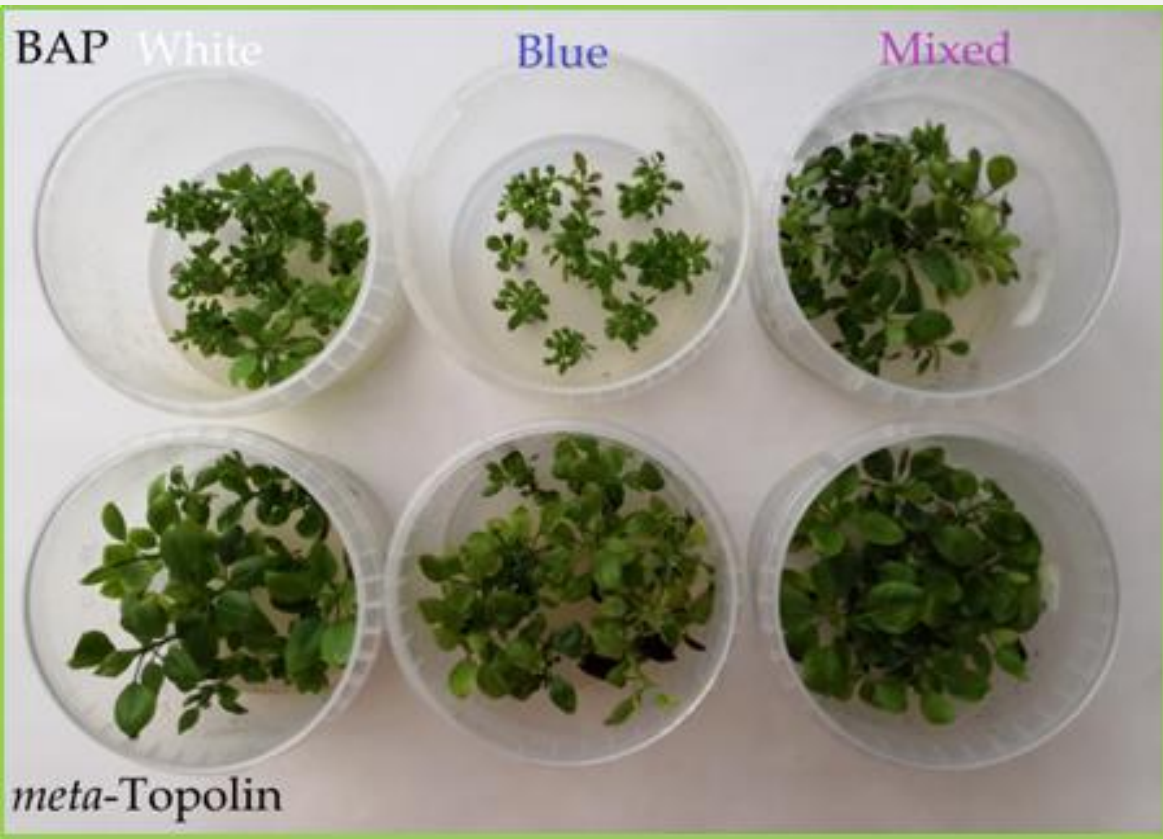


Fig. 1. The appearance of pear plantlets, grown with BAP or mT in the nutrient medium at different light treatments. W white LEDs, B – blue LEDs, BR – mixed LEDs.

Table 1. Growth indices measured in pear plantlets grown with BAP or mT in the nutrient medium at different light treatments. W white LEDs, B – blue LEDs, BR – mixed LEDs. For each column, different letters indicate significant differences at $p \leq 0.05$.

LED Light	Cytokinin	Length of Shoot /mm/	Number of Shoots	Number of Leaves	FW /g/	DW /g/
White	BAP	20.76 a	1.2 a	7.3 ab	1.20 a	0.34 ab
	mT	15.96 b	1.0 a	9.2 ab	1.55 a	0.47 a
BR	BAP	11.98 c	1.6 a	10.4 a	0.67 a	0.15 b
	mT	20.58 a	1.0 a	7.5 ab	0.98 a	0.18 b
Blue	BAP	21.96 a	1.6 a	9.1 ab	1.17 a	0.29 ab
	mT	15.90 b	1.1 a	5.7 b	1.28 a	0.34 ab

Table 2. The content of photosynthetic pigments (mg g⁻¹ FW) in the pear plantlets cultivated with BAP or mT in the nutrient medium at different light treatments. W white LEDs, B – blue LEDs, BR – mixed LEDs. For each column, different letters indicate significant differences at $p \leq 0.05$.

LED Light	Cytokinin	Chl a	Chl b	Chl (a+b)	Car	Chl a/b	Chl(a+b)/Car
White	BAP	0.52 a	0.17 a	0.69 a	0.23 a	3.05 ab	2.95 b
	mT	0.26 cd	0.09 bc	0.35 c	0.14 b	2.96 b	2.58 c
BR	BAP	0.25 cd	0.09 bc	0.34 c	0.15 b	2.58 c	2.31 d
	mT	0.21 d	0.08 c	0.30 c	0.11 b	2.61 c	2.74 bc
Blue	BAP	0.39 b	0.12 b	0.51 b	0.16 b	3.15 ab	3.26 a
	mT	0.32 bc	0.10 bc	0.42 bc	0.16 b	3.29 a	2.63 b

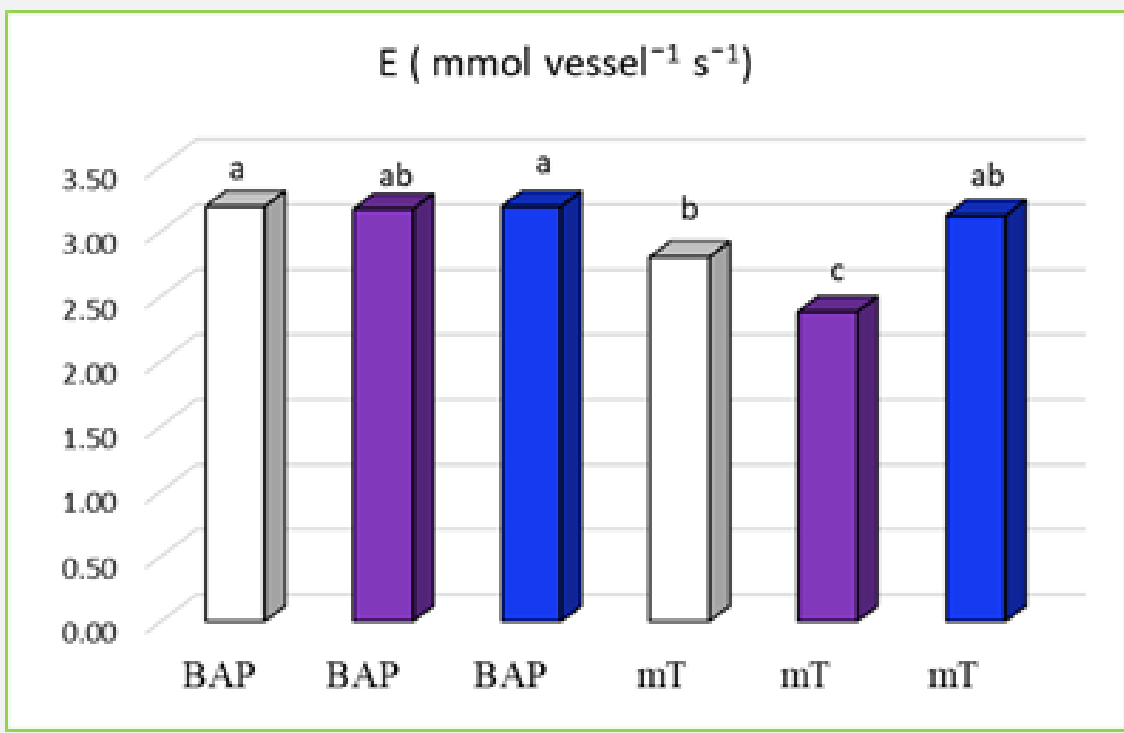
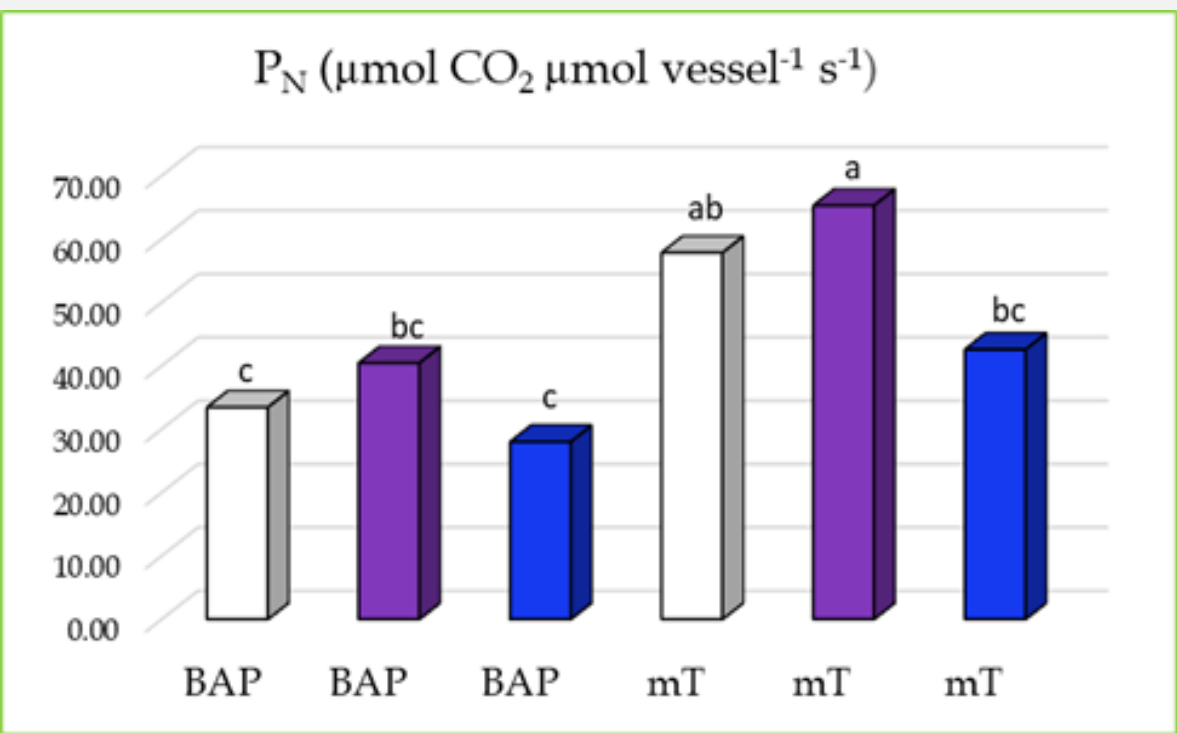


Fig. 4. Effect of the light and cytokinin on the net photosynthetic rate ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$) and transpiration intensity (E , $\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$) of pear plantlets; Different letters within column indicated difference at ($P < 0.05$).

Conclusions

Plantlets grown on the nutrient medium enriched with mT in polypropylene vessels with green gas permeable filter under white light had the largest fresh and dry mass, large leaf size and maximum net photosynthesis rate.

In addition, the better performance of plants grown under mixed LED light in terms of leaf size and photosynthetic performance showed that it is necessary to optimize the *in vitro* growing conditions of the pear rootstock OHF 333 by appropriately combining the light regime and cytokinin in the nutrient medium.

ACKNOWLEDGEMENTS

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